



The journey to change minerals exploration using ultrafine soils and data analytics

Ryan Noble (on behalf of many)



The issue





The origin





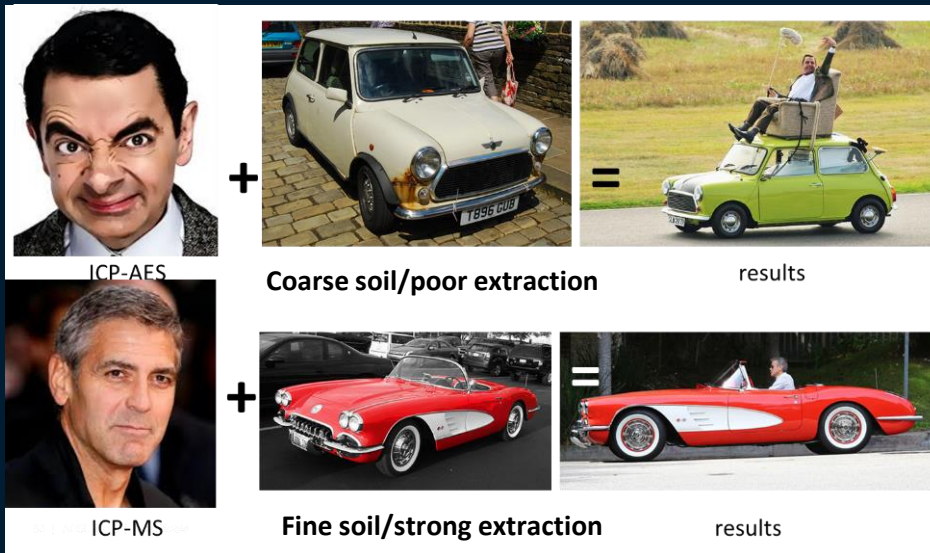
The origin



RS017-11



The need



Modified from Nick Oliver, HCOV Consulting





The solution

- Current “best” offering for commercial laboratories

10	Element	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Dy	Er	Eu	Fe	Ga	Gd	Ge	
11	Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	
12	DL	0.01	10	0.5	0.2	0.2	0.1	10	0.05	0.05	0.2	2	0.1	0.2	0.02	0.05	0.02	100	0.05	0.05	0.05	
13	Method	T-AP-004	T-AP-004	T-AP-004	T-AP-004	T-AP-004	T-AP-004	T-AP-004	T-AP-004	T-AP-004	T-AP-004	T-AP-004	T-AP-004	T-AP-004	T-AP-004	T-AP-004	T-AP-004	T-AP-004	T-AP-004	T-AP-004	T-AP-004	
14	ClientID/Scheme	SAMPLE ID																				
15	07-33381	NBD-05-01	0.10	12.2%	20.6	48.7	0.8	2.1	3820	<0.05	21.3	2.9	258	0.7	68.7	1.36	0.68	0.42	19.5%	50.9	1.56	0.74
16	07-33382	NBD-05-02	0.11	14.1%	27.5	43.0	1.0	2.9	1410	<0.05	21.0	3.0	320	0.9	67.2	1.41	0.70	0.42	24.7%	56.5	1.62	0.82
17	07-33383	NBD-05-03	0.11	13.4%	28.3	49.3	0.9	2.9	2290	<0.05	20.8	3.0	289	0.8	77.0	1.35	0.69	0.41	24.5%	58.6	1.56	0.82
18	07-33384	NBD-05-04	0.10	12.4%	24.8	43.4	1.0	2.6	1510	<0.05	15.6	2.9	321	0.8	61.8	1.14	0.58	0.35	21.8%	59.1	1.24	0.80
19	07-33385	NBD-05-05	0.10	13.5%	32.1	43.2	1.0	2.7	1310	<0.05	25.6	2.5	324	1.1	51.8	1.53	0.75	0.48	24.5%	59.9	1.77	0.77
20	07-33386	NBD-05-06	0.10	13.0%	30.3	41.7	1.0	2.6	1400	<0.05	18.0	2.5	319	0.8	51.3	1.27	0.59	0.40	26.8%	61.2	1.42	0.75



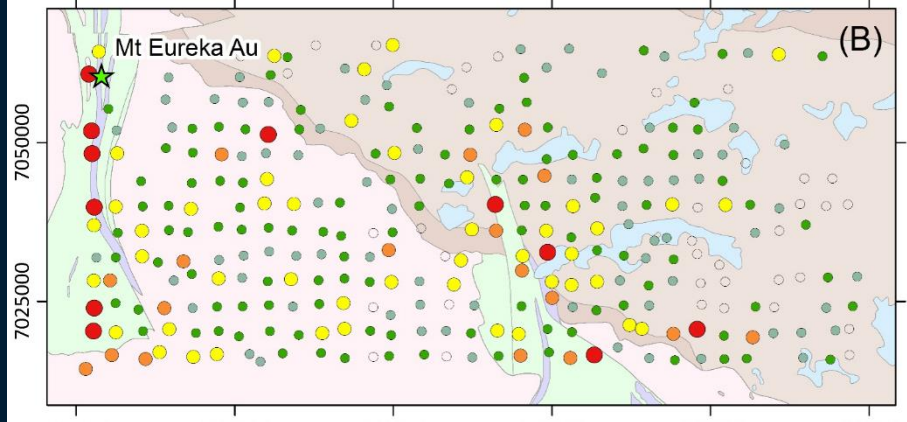
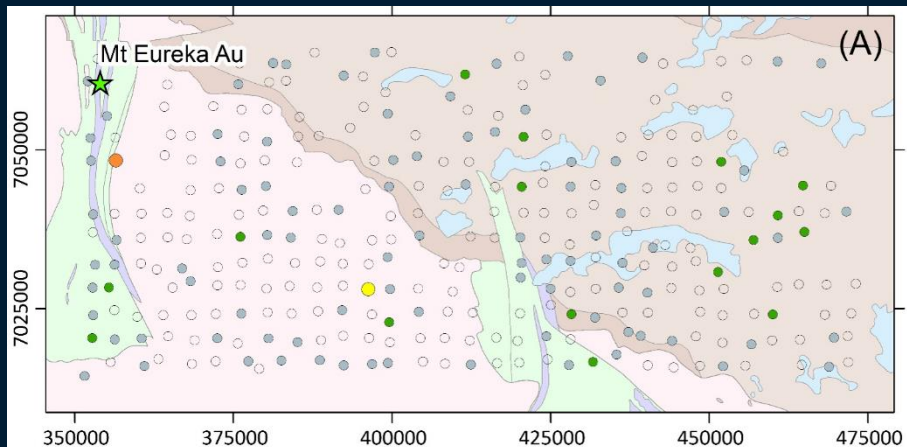
- UltraFine+ workflow

1	Line	LocalX	Locality	Easting M	Northing S	Sample D	Comment	Element	Ag	Al	As	Au	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Dy	Er	Eu	Fe	Ga	Gd	Ge
2	1	19875	50600	583218.6	6904667	5-10kg surface soil		15GY50001	0.05	113000	7.9	3.3	79.6	1.9	0.4	1920	0.08	46.7	15.6	105	5.7	2	2	2	2	2	2	2	2
3	1	19900	50600	583242.1	6904676	5-10kg surface soil		15GY50002	0.05	103000	7.8	3.3	84.4	1.8	0.4	1930	0.08	47.2	14.3	108	5.2	2	2	2	2	2	2	2	2
4	1	19925	50600	583265.6	6904684	14GYR0063		15GY50003	0.04	78000	7.7	2.5	61.3	1.6	0.4	2950	0.07	39.3	11.3	98	4.6	2	2	2	2	2	2	2	2
5	1	19950	50600	583281.1	6904693	15GV134 first m BC		15GY50004	0.05	71900	7.8	2.6	53	1.5	0.4	1800	0.07	37.5	12	98	4.6	2	2	2	2	2	2	2	2

Au	Te	Th	Bi	Br	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL
<0.01	<0.2	14.8	706	0.6	1.02	139	0.4	14.3	57.9	25	39.93	6.91	25.75	233	37.37455	53.79097	36.29036	4.930748	0.907594	3.888241	0.153209	37		
<0.01	<0.2	13.8	696	0.5	0.98	138	0.4	13.6	49.3	22	40.28	7.08	52.02	235	25.94091	39.72478	45.85444	8.981279	2.538566	2.745024	0.117797			
<0.01	<0.2	13.4	619	0.5	0.93	130	0.4	11.6	39.1	21	39.77	6.97	24.53	236	32.25853	48.02374	40.72972	3.956541	1.026748	5.845989	0.375384	299		
<0.01	<0.2	13.7	578	0.5	0.92	134	0.4	10.9	35.2	21	40.16	6.89	23.6	237	38.23632	54.27159	35.18423	3.422889	0.765184	5.937452	0.384407	381		
<0.01	<0.2	12.5	565	0.4	0.85	122	0.4	9.9	38.5	20	40.08	6.85	24.11	238	35.91347	52.24549	42.27413	4.225678	0.772441	4.404015	0	338		
<0.01	<0.2	12.9	618	0.5	0.94	132	0.4	10.7	40.7	21	40.34	6.5	31.01	239	36.11812	53.35606	38.92852	6.10149	1.752677	2.188788	0.132922	316		

1	Specific Si	Dx (10)	Dx (50)	Dx (90)	Sample N	Mini	STSA	W1	STSA	W1	STSA	kaolin	abi	1400D	3p	2200AR	3	Water	ab	ferric	oxi	hem	goe	colour	p	Albedo	Mini	STSA	W1	STSA	Error	STSA	((1000R)	13800	wm	Atema	wm
2	37976.8	0.054406	1.016206	49.24355	FSFR.1829	kaolinite-	0.569	57.034	0.253	0.135	16.505	0.163	0.0897	893.39	5YR 4/4	0.284	NULL	NULL	NULL	0.837	0.00842	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	0.837	0.00842	NULL	NULL	NULL	NULL	
3	23333	0.078692	4.972019	72.43388	FSFR.1829	kaolinite-	0.576	78.643	0.294	0.157	19.213	0.257	0.0961	895.28	5YR 3/2	0.181	NULL	NULL	NULL	0.806	0.0105	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	0.806	0.0105	NULL	NULL	NULL	NULL		
4	29700.16	0.066311	2.487504	60.94927	FSFR.1829	kaolinite-	0.71	81.155	0.284	0.163	18.649	0.259	0.103	894.47	5YR 3/4	0.284	NULL	NULL	NULL	0.887	0.0113	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	0.887	0.0113	NULL	NULL	NULL	NULL		
5	38177.68	0.054618	6.865788	54.94152	FSFR.1829	kaolinite-	0.592	44.691	0.207	0.116	13.627	0.183	0.0778	893.62	5YR 4/4	0.284	NULL	NULL	NULL	0.875	0.00622	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	0.875	0.00622	NULL	NULL	NULL	NULL		
6	33820.93	0.060499	1.433667	29.53599	FSFR.1829	kaolinite-	0.683	81.21	0.326	0.17	21.478	0.275	0.105	895.62	5YR 3/4	0.284	NULL	NULL	NULL	0.828	0.0116	NULL	NULL	NULL	NULL	NULL	NULL	NULL	0.526	245.69	0.828	0.0116	NULL	NULL	NULL	NULL	
7	35510.83	0.050697	1.585926	48.43578	FSFR.1829	kaolinite-	0.547	66.452	0.249	0.137	16.113	0.238	0.0804	855.12	5YR 3/4	0.284	NULL	NULL	NULL	0.809	0.00778	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	0.809	0.00778	NULL	NULL	NULL	NULL		
8	25338.1	0.073752	4.465595	62.60766	FSFR.1829	kaolinite-	0.501	59.575	0.242	0.132	15.538	0.232	0.0765	894.45	5YR 3/4	0.284	NULL	NULL	NULL	0.862	0.00695	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	0.862	0.00695	NULL	NULL	NULL	NULL		







- End of M462
 - ~3000 samples
 - ↑ 250% Au and pathfinder elements, ↓ bdl especially for Au, added Pd and Pt
 - Au focus (with a little Cu Zn test work)
 - Proof of concept and commercial viability
 - Translation to commercialised lab and trademark
- M462a?...
 - Now how can we improve the interpretation (for SMEs)?
 - Geochemistry and landscape knowledge
 - Challenge was funding to be bigger and bolder – SMEs can't do this even collectively



The gap year and next phase

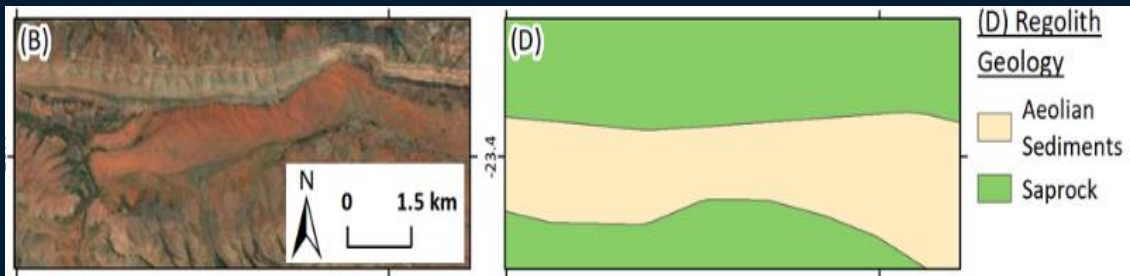
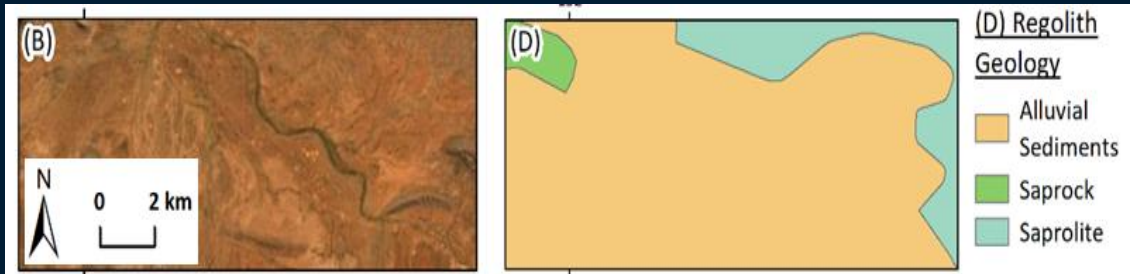


- M462a?... How can we improve the interpretation (for SMEs)?
 - Geochemistry and landscape knowledge
 - Funding challenge to be bigger and bolder – SMEs can't do this



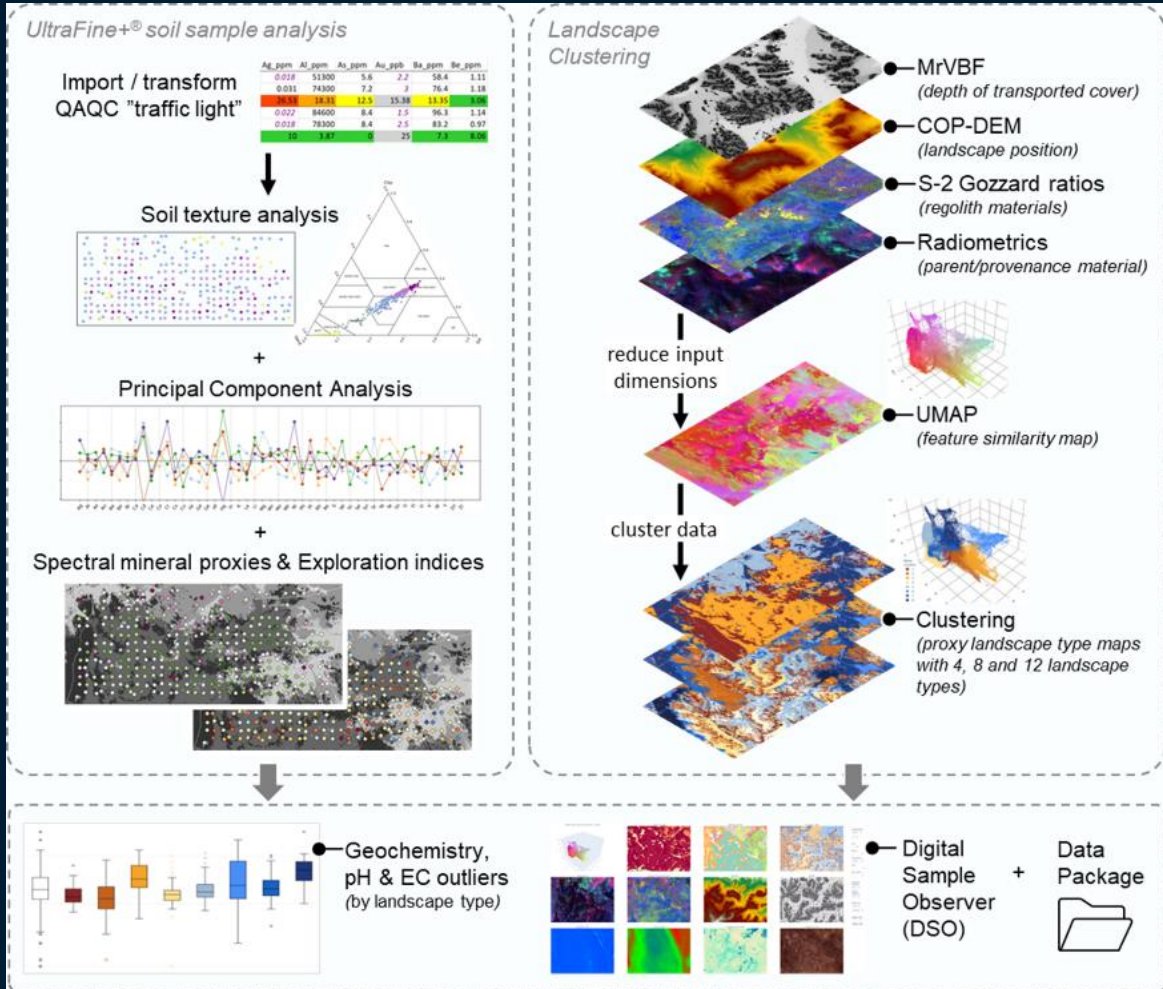


The reality



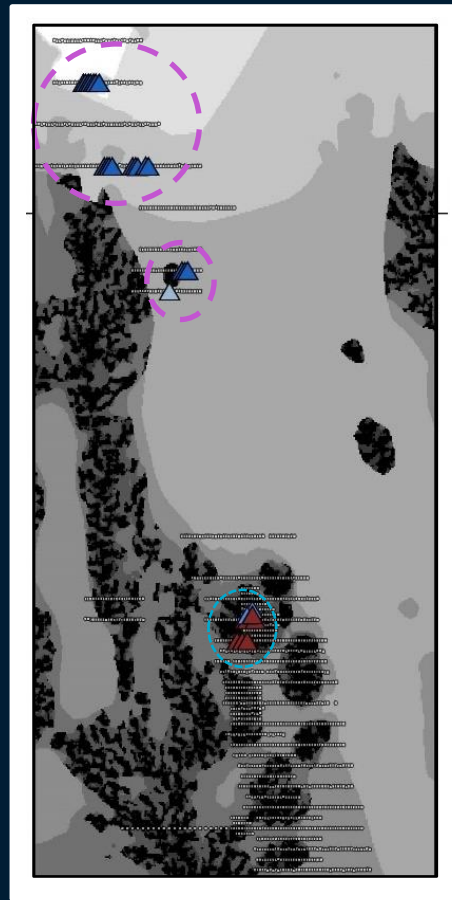
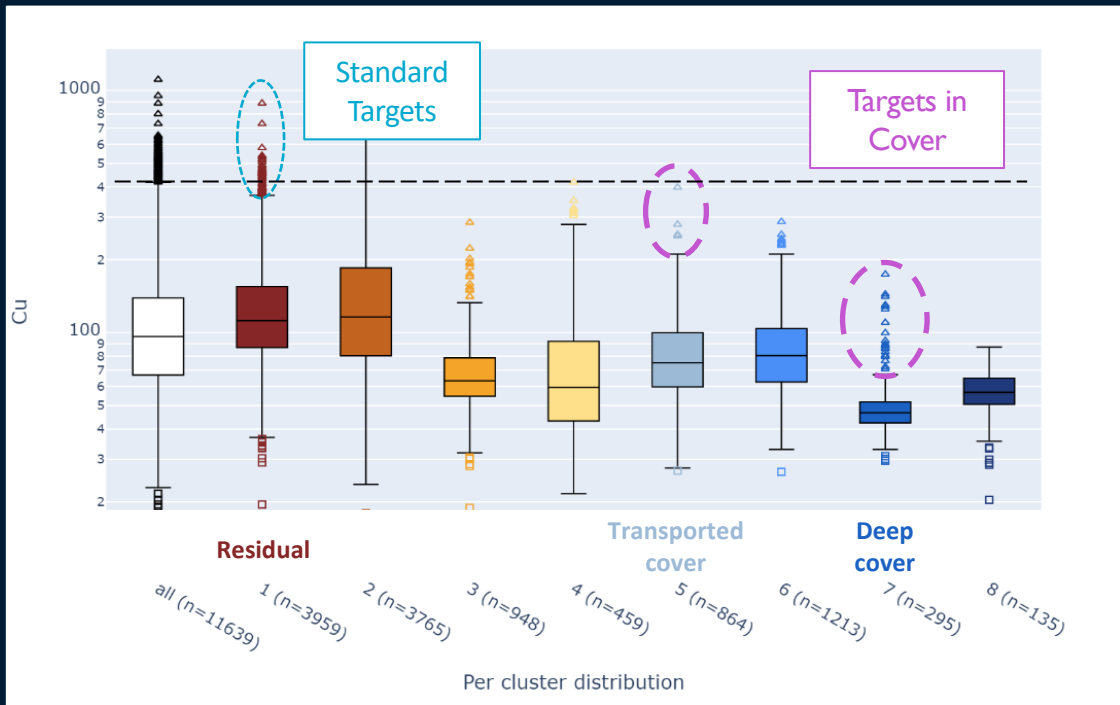


The solution



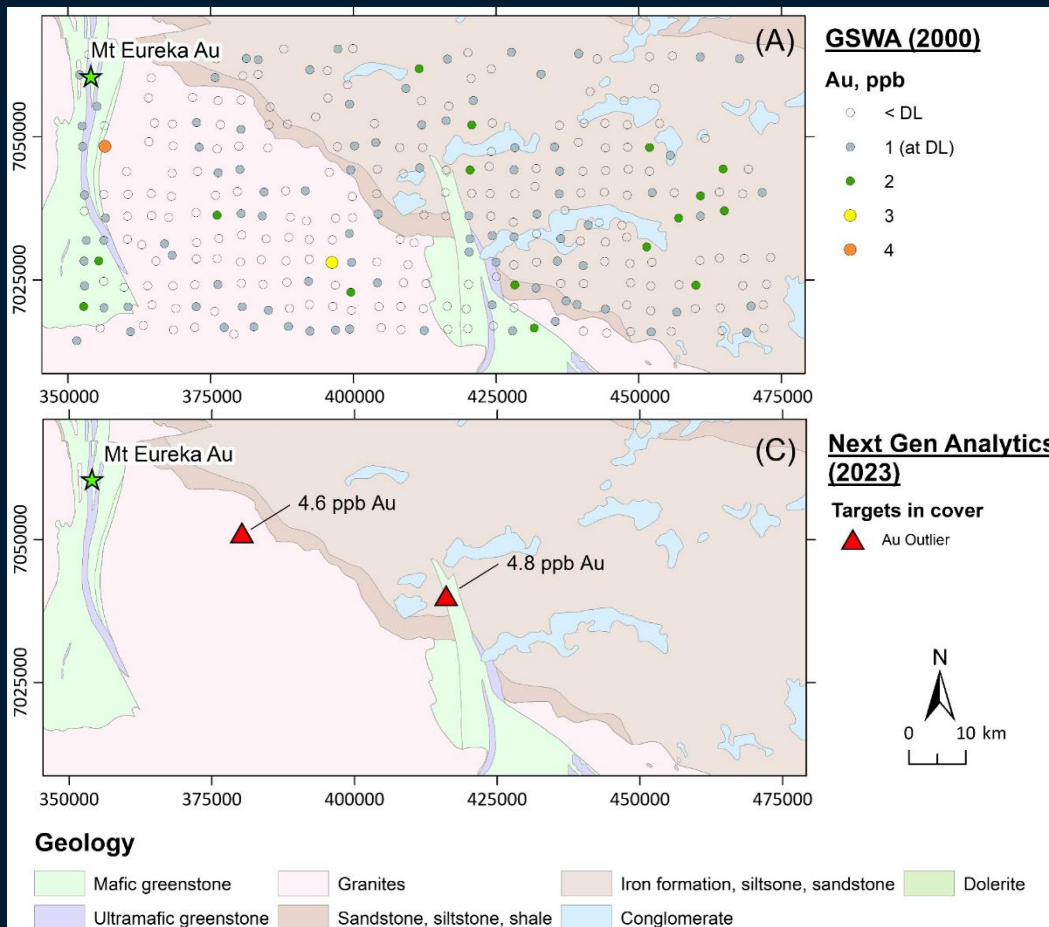


The outcome





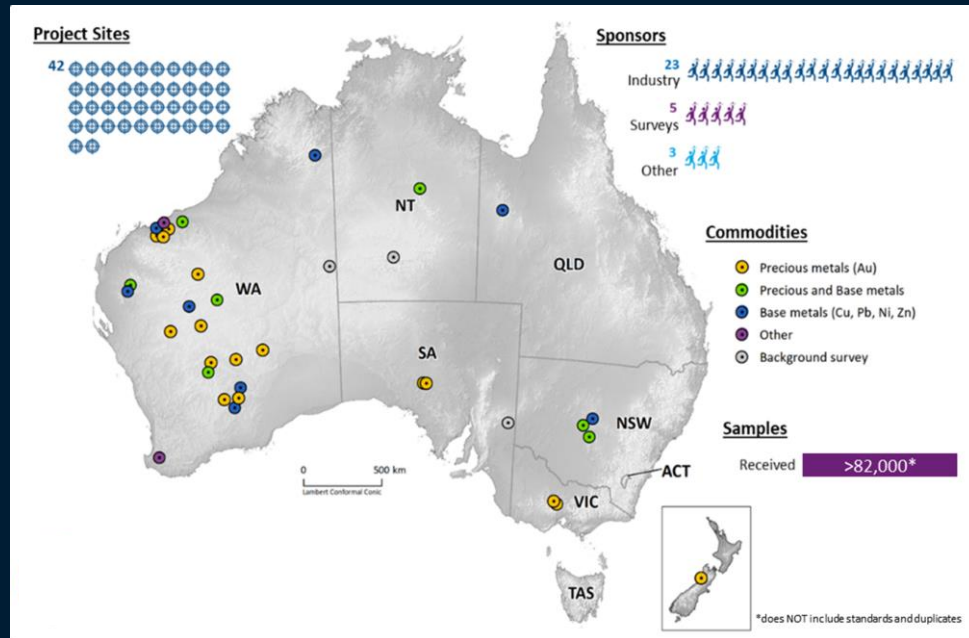
+ PCA, exploration indices, regolith ratios, spectral parameters
 +New targets, new interest, new commodities





The outcomes

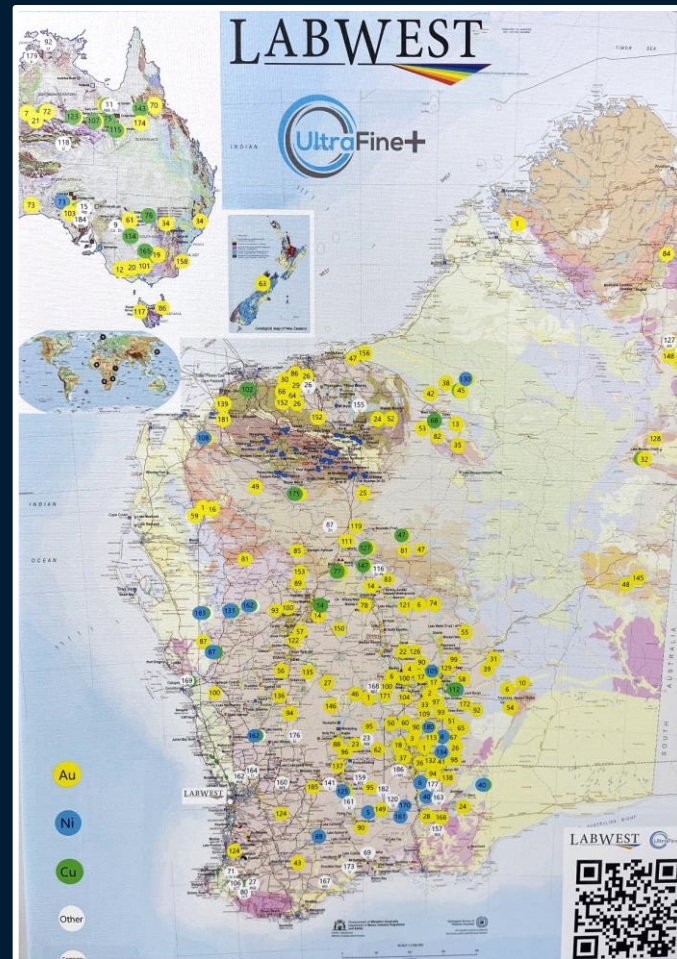
- End of M462a
- Viable for nearly all critical metals in cover (tested Li, REE, PGE)
- Next Gen Analytics data package
- SME uptake





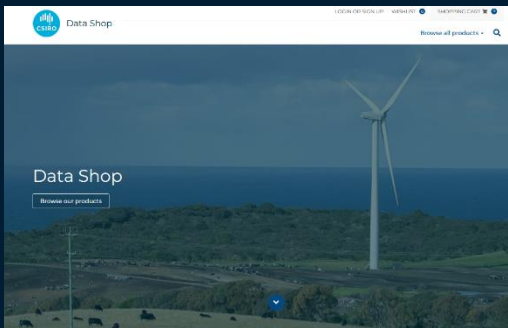
The outcomes

- LabWest ~2000 samples A WEEK
- LabWest staff expanded from 6 to 45





The future



LandScape+

Job Area Preview

Configure Job

- Defining a Job Area**
- Defining Masks**
- Setting the Area Buffer**
- Selecting the number of clusters**

Upload Sample Data

Missing Clusters

Sample Clusters Assignment

ID	Cluster	Area	Volume	Perim	Centroid	Centroid	Centroid	Centroid	Centroid
1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9
10	10	10	10	10	10	10	10	10	10

Warnings:

- Warning: Landscape: Missing value at row 12?
- Error: Landscape is reported that has not been assigned to a volume in the file
- Error: Au: Non numeric value of row 55, 57

LandScape+ M462b

Select Clusters

Landscape Map

Landscape Verification

Sample Clusters

Display Type

Map Overlay

- M462b? Probably not now, but will reload for a new challenge



The supporters





The UltraFine+® CSRIO Team

Mineral Resources

Ryan Noble
Ryan.Noble@csiro.au
08 6436 8684



